MEMO

State of Idaho
Department of Water Resources
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Date: August 7, 2014

To: Remington Buyer; Water Supply Bank Coordinator

From: Mike McVay, Technical Hydrogeologist

Subject: Evaluation of Tanner Lane Ranch Water Supply Bank Rental Application

Introduction

Per your request, I have performed a technical review of the Tanner Lane Ranch Water Supply Bank (WSB) application.

Proposal Summary

Tanner Lane Ranch proposes to rent Blackfoot River water from leased water rights located near the Blackfoot Reservoir. The proposed rental Points of Diversion (PODs) are located near the city of Blackfoot and consist of two wells located approximately 0.6 and 1.0 miles from the Blackfoot River, respectively (Figure 1). Rented water would be used to irrigate a 288-acre place of use (POU) located within the Eastern Snake Plain Aquifer (ESPA) model boundary.

The applicant has submitted evidence that the Blackfoot River is connected to the regional aquifer. The applicant postulates that the nature of the hydraulic connection is such that withdrawing water from the wells is equivalent to withdrawing water directly from the river.

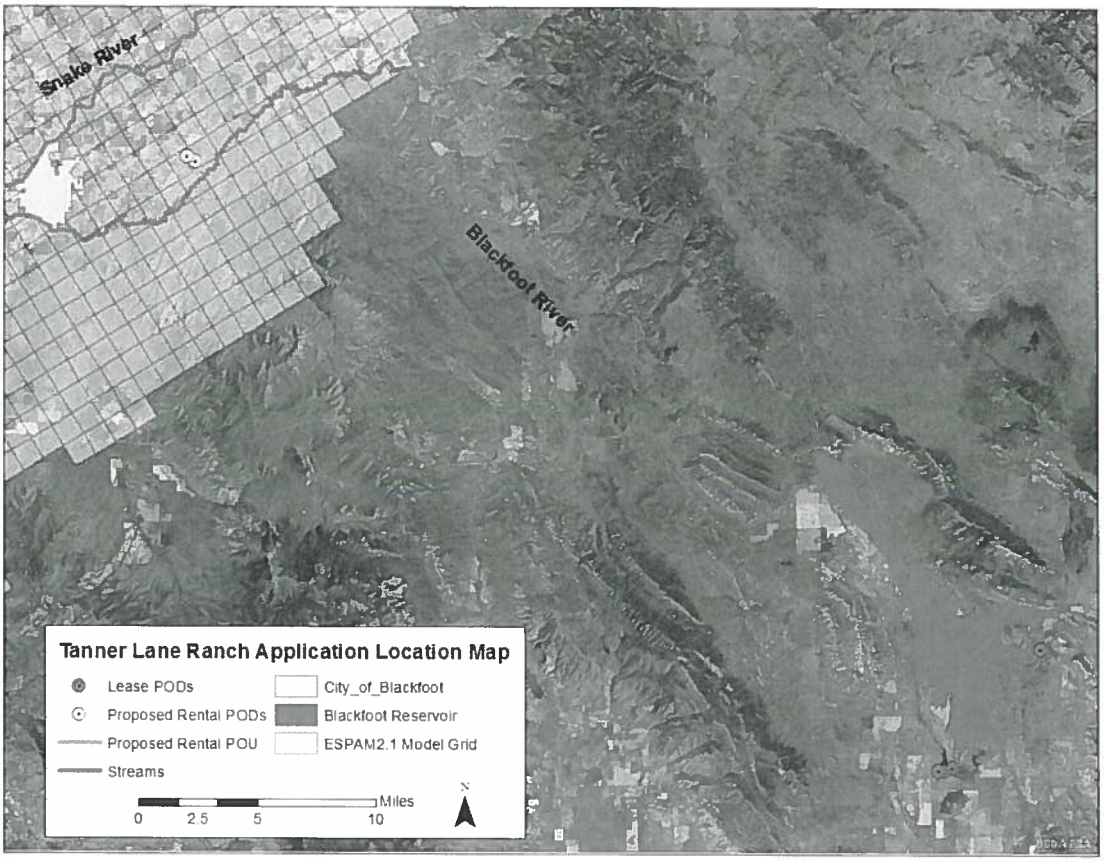

Figure 1. Map showing the location of leased PODs, proposed rental PODs, and proposed rental POU.

Leased Water Rights

The applicant proposes to rent two leased surface water rights (27-7071 and 27-7072) and possibly one groundwater right (27-7073), all located near the south end of Blackfoot Reservoir (Figures 1 and 2).

Water Right 27-7071 has a priority date of 02/11/1977, authorizing diversion from Hole in the Rock Lake (tributary to Blackfoot Reservoir) of 3.68 cfs for irrigation. The right has a period of use from 05/01 to 10/15 and a volume limit of 1,080 acre-feet/year.

Water Right 27-7072 has a priority date of 03/09/1977, authorizing diversion from Dike Lake (tributary to Blackfoot Reservoir) of 3.68 cfs for irrigation. The right has a period of use from 04/15 to 10/31 and a volume limit of 1,043 acre-feet/year. The right states that the source is groundwater; however, there is a note in the water-right back file clarifying that the source is Dike Lake. Water flows over a weir from Dike Lake into a sinkhole, from which water is pumped.

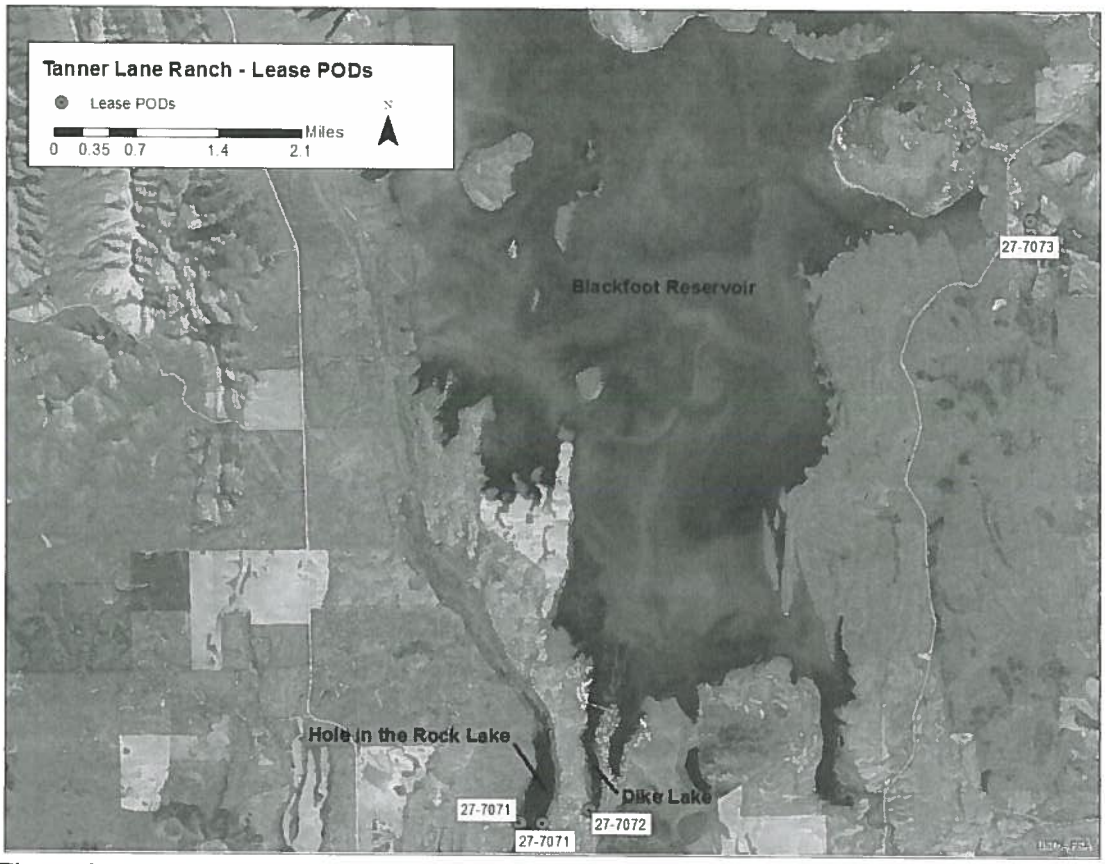

Figure 2. Locations of leased water rights that the applicant proposes to rent for use on the ESPA.

The application offers that water right 27-7073 is available for rent. Water Right 27-7073 has a priority date of 02/11/1977, authorizing diversion from groundwater of 3.79 cfs for irrigation. The right has a period of use from 04/01 to 11/01 and a volume limit of 1,107 acre-feet/year.

Water right 27-7073 is not an appropriate water right for transfer to the ESPA for the following reasons:

1. Groundwater transfers within the ESPA must include calculated depletions to the Snake River using IDWR's current groundwater model of the ESPA or an equivalent analysis (IDWR, 2009). The location of 27-7073 is too far away from the ESPA to migrate calculated groundwater depletions in this area to the ESPA model. IDWR policy states that in order to process transfers between the ESPA and tributary basis, locations father than two model cells away from the ESPA model boundary must include a separate analysis of the impacts between the non-modeled basin and the ESPA (IDWR, 2007).
2. The groundwater in the Blackfoot Reservoir area is not strongly connected to the ESPA. The Blackfoot River flows northwest toward the ESPA over variable mountain geology that does not support significant aquifers (Figure 3; IDWR,

2014). Seepage from the river most likely only supports groundwater in adjacent and underlying alluvial sediments.

3. Third, the groundwater in the reservoir area is not entirely tributary to the ESPA. Although the surface water is tributary to the Snake River basin, a portion of groundwater in this area is tributary to the Bear River basin (Dion, 1974).

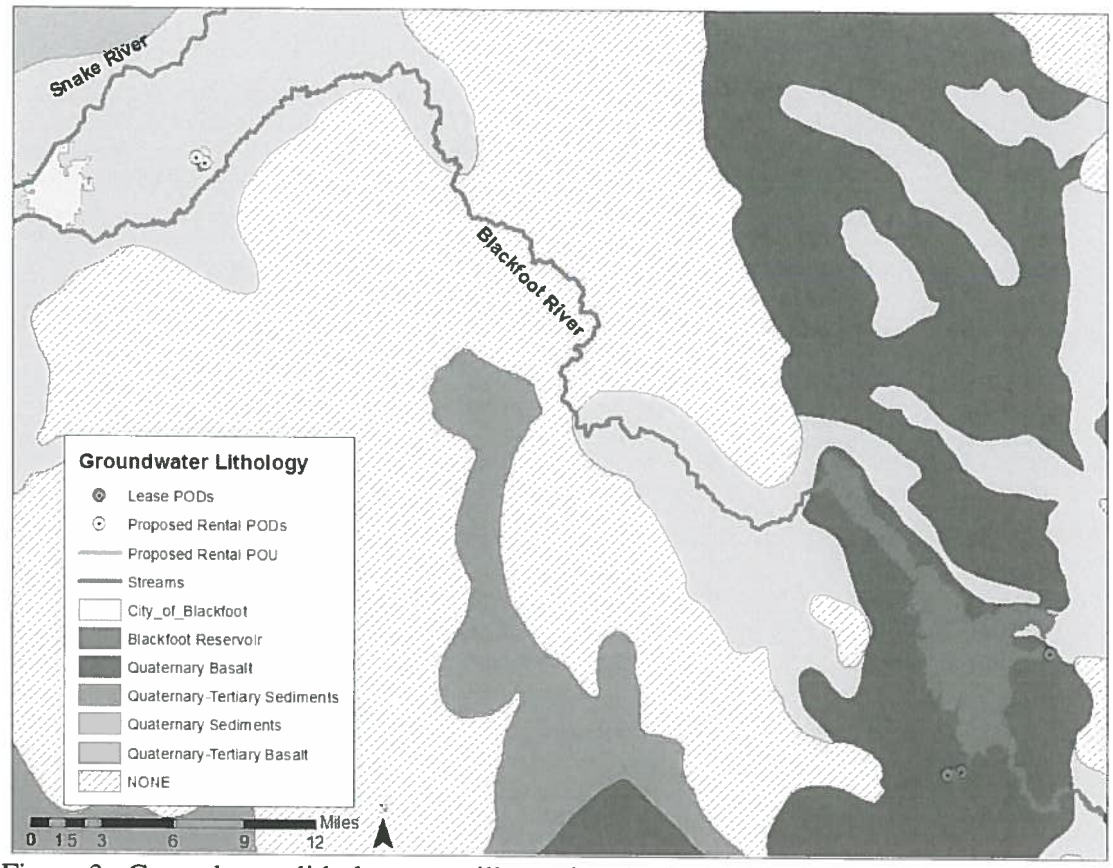

Figure 3. Groundwater lithology map illustrating the lack of aquifer material between Blackfoot Reservoir and the ESPA.

Proposed use of Rental Water

The proposed rental would be used to irrigate 288 acres of land overlying the ESPA near the City of Blackfoot. The proposed PODs are two existing wells located approximately 0.6 and 1.0 miles from the Blackfoot River, respectively (Figure 4).

Because the applicant proposes to rent surface-water rights and use groundwater PODs, the rental constitutes a Change of Source. Therefore, in order to comply with IDWR water-right transfer policy, the groundwater and surface-water sources must have a "direct and immediate hydraulic connection" by which "at least 50 percent depletion in original source occurs due to depletion at the proposed POD in one day" (IDWR, 2009). In other words, at least 50 percent of the water pumped from the wells must come from the Blackfoot River within one day.

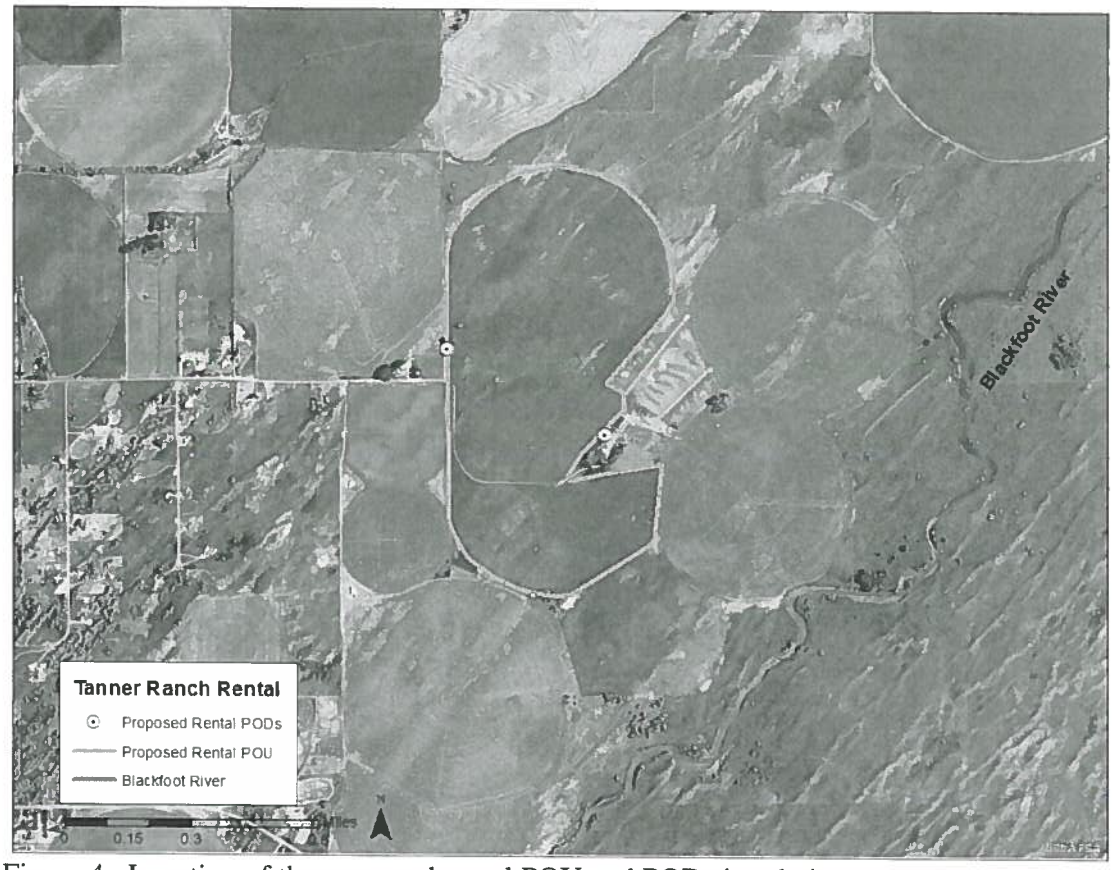

Figure 4. Location of the proposed rental POU and PODs in relation to the Blackfoot River.

Tanner Lane Ranch Local Hydrogeology

The principal lithologic units present in the lower Blackfoot area consist of modern Snake River flood-plain deposits, older Snake River terrace deposits, aeolian deposits, lacustrine deposits, and basalt of the Snake River Group (Parliman, 1987; Figures 5 and 6). Previous research in the area, and a review of local driller's reports, indicate that the depth to basalt is approximately 100 feet in this area (Appendix A). Locally, in areas where the basalt has been eroded, the thickness of sediments may be deeper (Parliman, 1987); however, most wells near the proposed POU access water from sand and gravel within 80 feet of land surface (Appendix A).

The regional aquifer system consists of Snake River Group basalts and associated interbeds. However, perched groundwater that results from surface-water irrigation is found in sediments located above the basalt, and is an important component of the local hydrology. Figures 5 and 6 illustrate the geologic setting of the lower Blackfoot area. Although the rental POU is approximately 6 miles NE of the cross-section, the geology appears to be consistent with that illustrated in Figures 5 and 6.

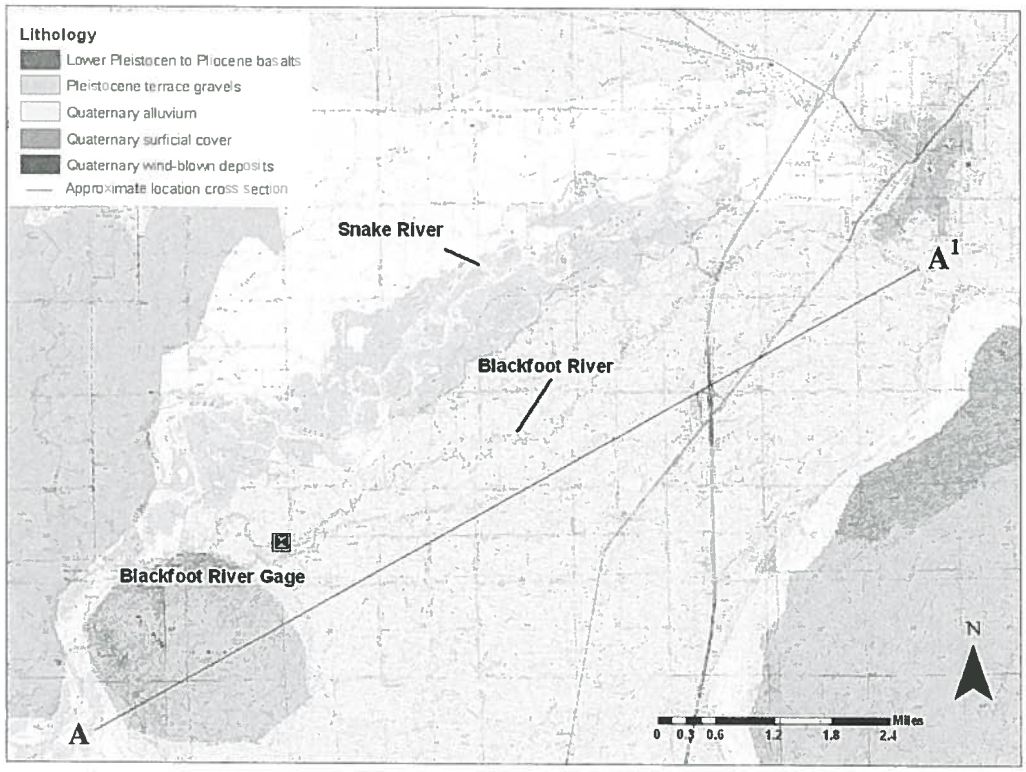

Figure 5. Lithology in the lower Blackfoot area. The black line illustrates the approximate location of the cross-section shown in Figure 6.

It is important to note that the Blackfoot River traverses over terrace deposits overlying the ESPA, and is entrenched in the deposits in the area of the proposed rental POU.

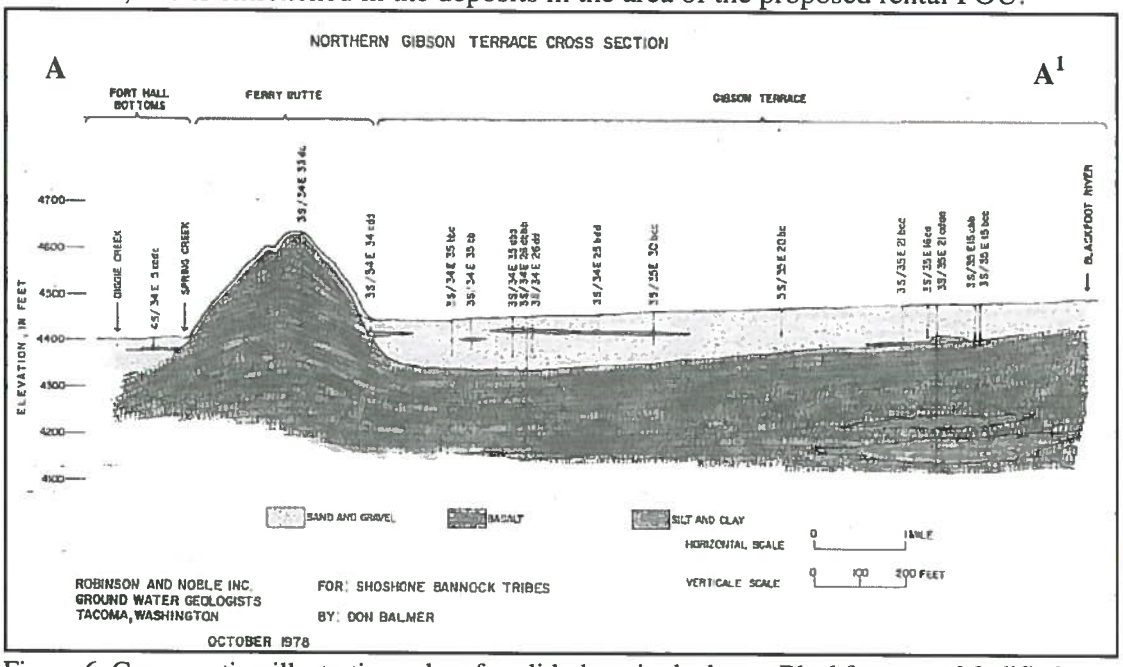

Figure 6. Cross-section illustrating subsurface lithology in the lower Blackfoot area. Modified from Balmer and Noble, 1979.

Elevation Profile Analysis

The first step in determining the appropriateness of the rental proposal is to determine if the Blackfoot River is hydraulically connected to groundwater. One method of assessing connectivity between the river and groundwater is to compare the river-bed elevation with the water-table elevation. During the development of the Enhanced Snake Plain Aquifer Model, it was assumed that there are approximately 30 feet of saturated sediments below the Snake River. This means the river is assumed to be connected to groundwater if the water table is within 30 feet of the river bed (Wylie, 2004). This concept further assumes that the river bottom is not sealed with fine-grained sediment, that there is no physical (geological) feature that would separate the river and the aquifer, and that the zone between the river bed and the aquifer remains saturated.

Although the 30-foot separation assumption for Snake River connectivity may not be strictly applicable to the Blackfoot River, it is reasonable to assume that the river is hydraulically connected to the aquifer if the distance between the bed of the Blackfoot River and water table is sufficiently small.

An elevation profile has been drawn across the Blackfoot River at the rental POU (Figure 7). The profile traces the land-surface elevation and the regional water table along the line, providing a cross-section of the spatial relationship between the Blackfoot River bed and underlying groundwater (Figure 8). Land-surface elevation is represented by the National Elevation Dataset 10-meter Digital Elevation Model and the water-table elevations have been estimated using Kriged surface representations of the spring and fall 2008 ESPA synoptic water-level measurements.

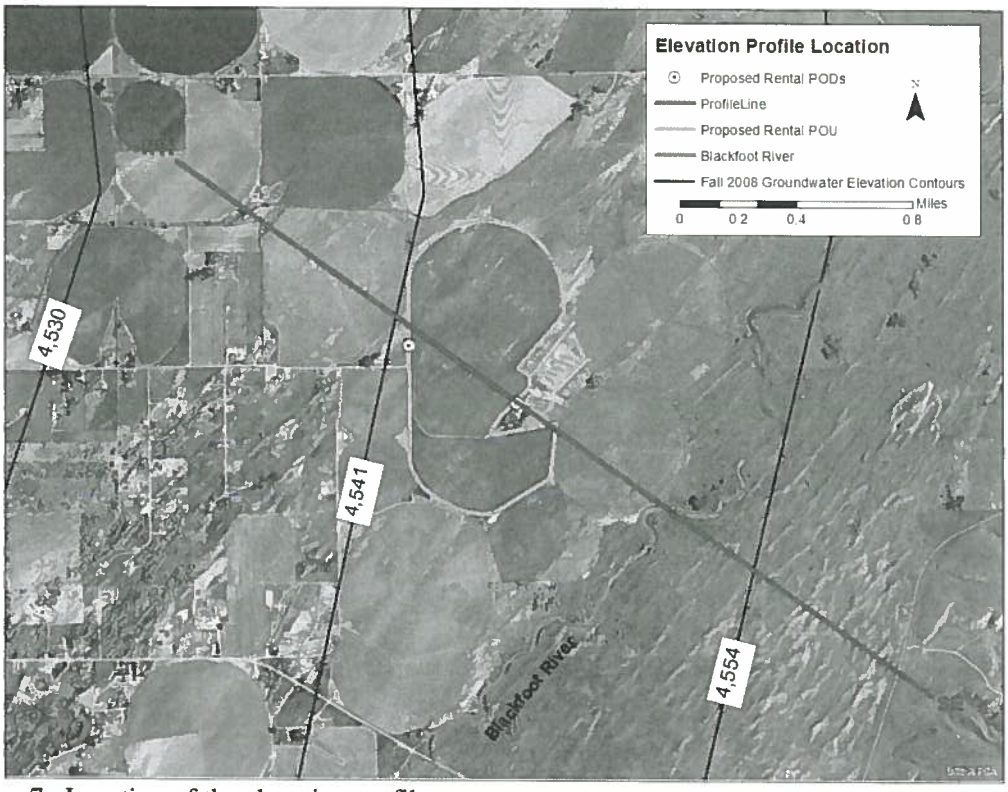

Figure 7. Location of the elevation profile.

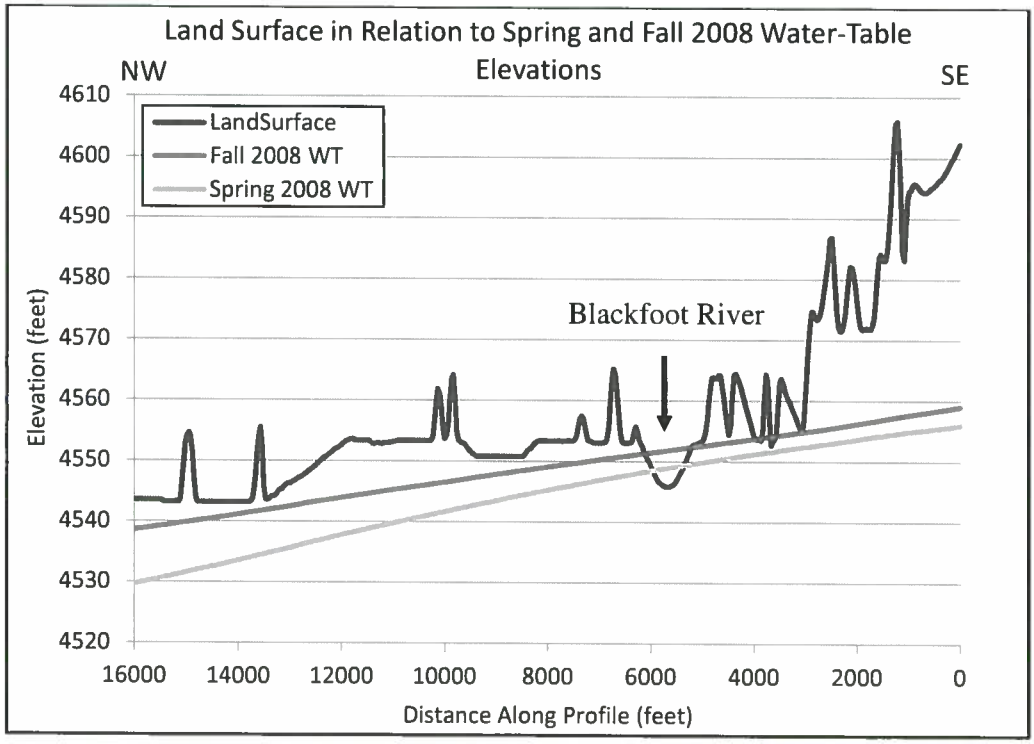

Figure 8. The profile illustrates the elevation of the Blackfoot river and the regional water table. Note that the water table is above the elevation of the Blackfoot River year-round.

Visual inspection of Figure 8 indicates that the water table is above the elevation of the Blackfoot River in this area during all seasons of the year. The relationship between the river and water table implies there is hydraulic connection between surface water and groundwater, and further implies that the Blackfoot River gains water from the aquifer in this area.

Stream Depletion due to Groundwater Pumping

Although the relative elevations of the Blackfoot River and the water table indicate hydraulic connection, the degree of hydraulic connection must be evaluated with regard to the proposed rental. Since this rental constitutes a Change in Use, the relationship between groundwater and surface water must be shown to have a "direct and immediate" hydraulic connection. IDWR policy states that "direct and immediate" hydraulic connection can only be demonstrated if at least 50 percent of the water pumped from the wells comes from the Blackfoot River within one day (IDWR, 2009).

Depletions to the river due to groundwater pumping at the proposed PODs have been estimated using an image well analysis (see, for example, Freeze and Cherry, 1979). This analysis uses stream-depletion equations developed by Glover (1978), and has been executed using a software program called the Integrated Decision Support Alluvial Water Accounting System (AWAS), developed at Colorado State University (IDS, 2014).

Input into the AWAS program includes the pumping rate, site geometry, boundary conditions, and aquifer properties. Inputs for evaluating stream depletion due to pumping of the proposed PODs are as follows:

1. Aquifer Boundary Condition – The aquifer boundary condition has been assigned as "Infinite Aquifer" due to the lack of an impermeable boundary to the northwest of the proposed PODs.
2. Transmissivity – The transmissivity for the area has been estimated using the available specific capacity data from nearby well driller's reports. Specific capacity estimates of transmissivity have been averaged to obtain 603,480 gallons per day per foot (Appendix B).
3. Specific Yield – The specific yield of an aquifer can only be determined via lab tests or pumping tests with observation wells. Since no known specific yield data for the area exists, an average textbook value for gravely sand of 0.25 has been used (Fetter, 1994).
4. Distance between wells and the river – The distances between the proposed rental PODs and the Blackfoot River have been estimated using GIS software. The well nearest to the river is at a distance of 3,050 feet, and the farthest well is at a distance of 5,200 feet from the river.
5. Pumping Rate – The rental application lists the maximum flow rate as 5.76 cfs which equates to 11.42 acre-feet per day. The daily volume has been distributed evenly between the two PODs for this analysis; resulting in 5.71 acre-feet per day per well.

Tables 1 and 2 summarize the inputs and results of the stream depletion analysis.

Table 1. Input parameters for stream depletion calculations using AWAS.

Well Name	Boundary Condition	Transmissivity (GPD/ft)	Specific Yield	Distance to River (feet)	Pumping Rate (acre-feet/day)
Tanner	Infinite Aquifer	603,480	0.25	3,050	5.71
Tanner2	Infinite Aquifer	603,480	0.25	5,200	5.71

Table 2. Results of stream depletion calculations for the first week of pumping.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Pumping Volume (acre-feet)	11.42	11.42	11.42	11.42	11.42	11.42	11.42
Volume from River (acre-feet)	0.0	-0.01	-0.1	-0.25	-0.43	-0.64	-0.84

Results of the stream depletion analysis indicate that the proposed POD wells obtain no (0.0 acre-feet) Blackfoot River water during the first 24 hours of pumping. Therefore, the proposed PODs are not in "direct and immediate" hydraulic connection with the Blackfoot River. The stream depletion analysis is located in Appendix C.

Summary

Tanner Lane Ranch has applied for a Water Supply Bank rental to provide irrigation for a 288-acre POU near the City of Blackfoot. The proposed rental is for a maximum diversion rate of 5.76 cfs, with a volume limit of 1,152 acre-feet. The proposed rental PODs consist of two wells located 0.6 and 1.0 miles from the Blackfoot River, respectively. The applicant proposes to rent two surface-water rights (27-7071 and 27-7072) and possibly one groundwater right (27-7073), all located near the Blackfoot Reservoir.

Because leased groundwater right 27-7073 is located in an area that is both poorly connected to, and a great distance from the ESPA, renting this right would result in increased use of water on the ESPA without the offsetting impacts due to the lease of the right.

Because 27-7071 and 27-7072 are for surface water, and the proposed rental PODs divert from groundwater, the rental of these rights constitutes a Change in Use. IDWR policy states that a Change of Use can only be approved if it is shown that at least 50% of the water pumped from the wells comes from the Blackfoot River within one day. A stream depletion analysis indicates that the rental PODs do not obtain any water from the Blackfoot River during the first day of pumping, and are not in "direct and immediate" hydraulic connection with the Blackfoot River.

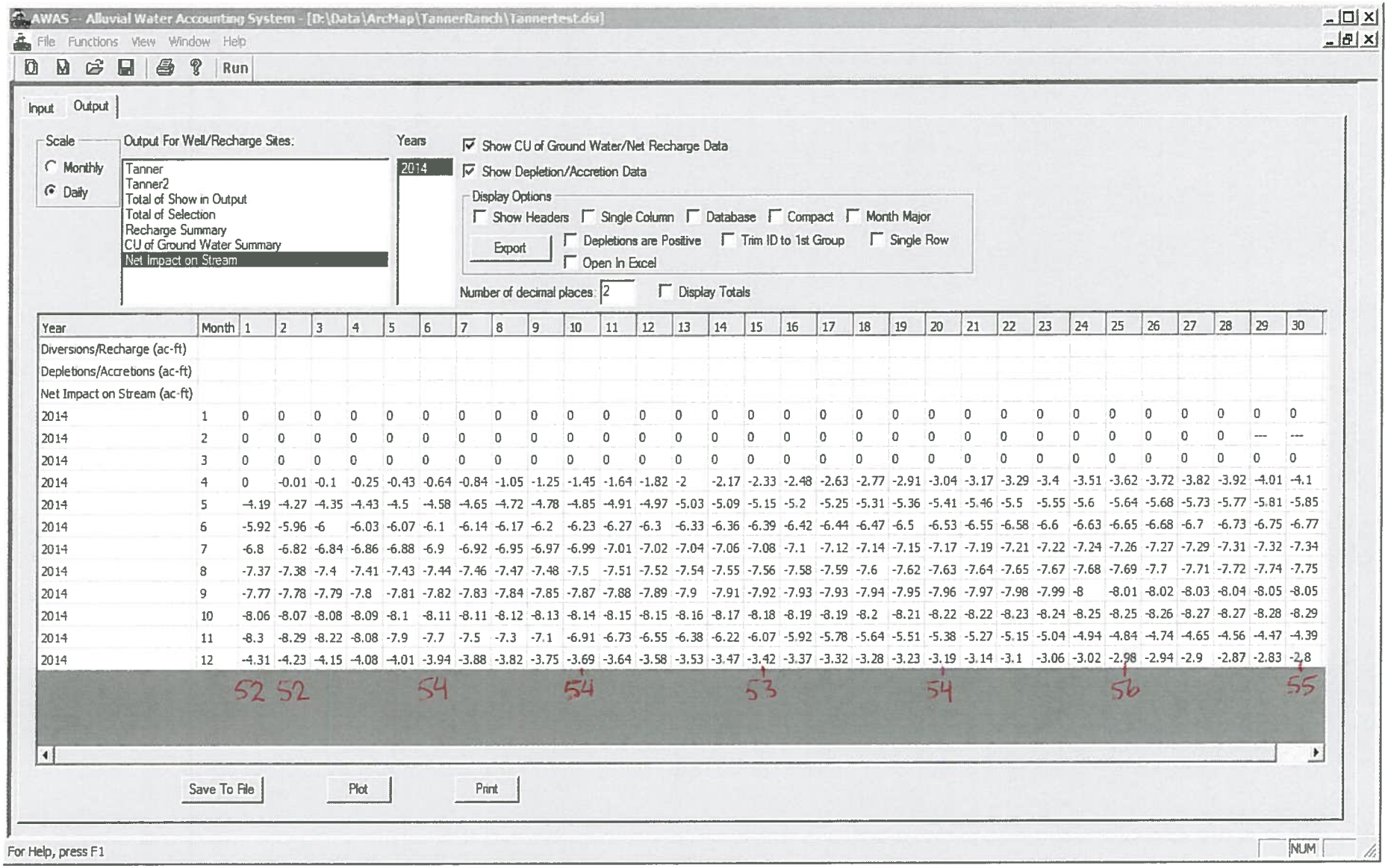

Figure C-4. Results of the stream depletion analysis. Output is depletions to the river in acre-feet.

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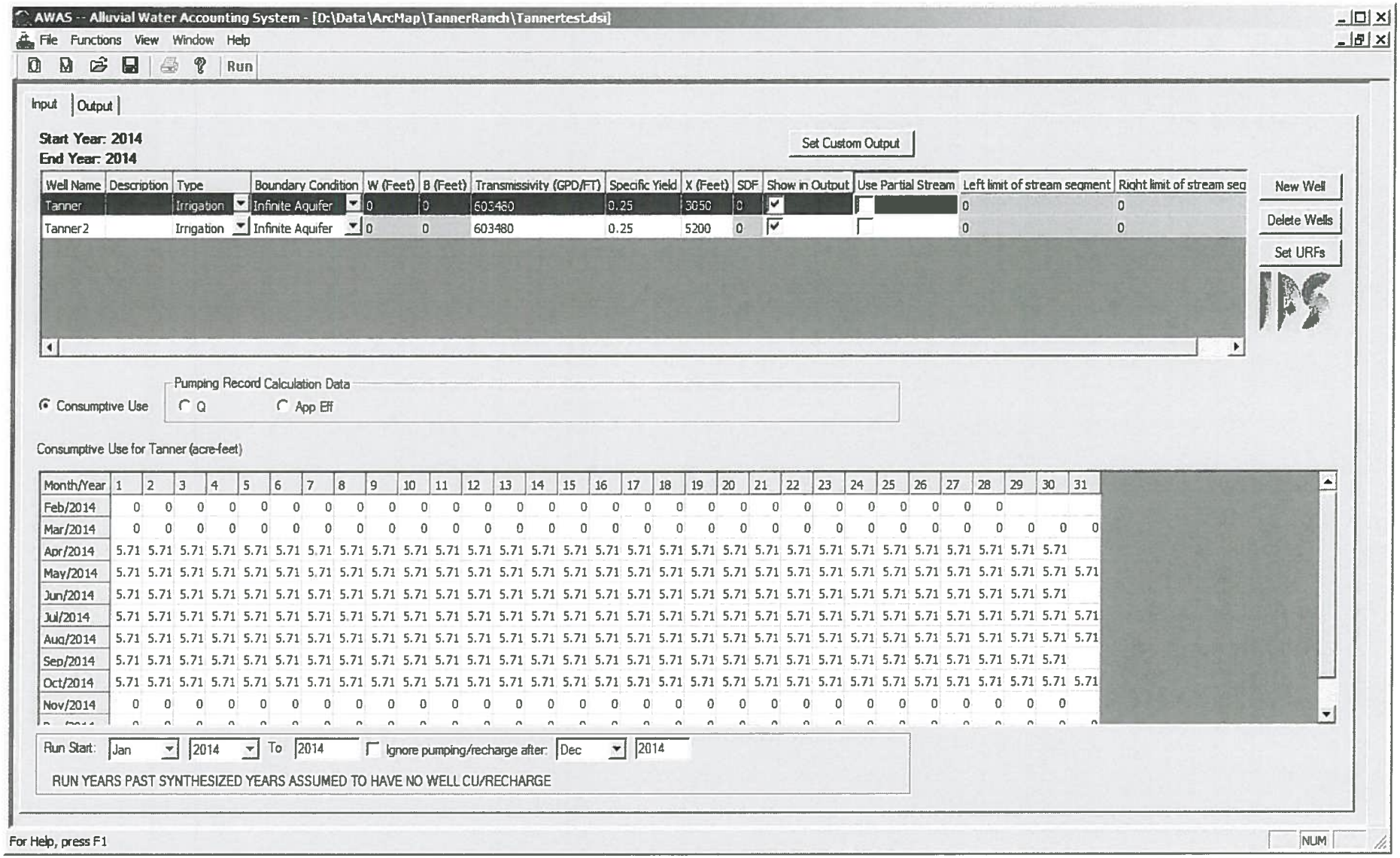

Figure C-2. Input parameters for the Tanner Lane Ranch well closest to the Blackfoot River.

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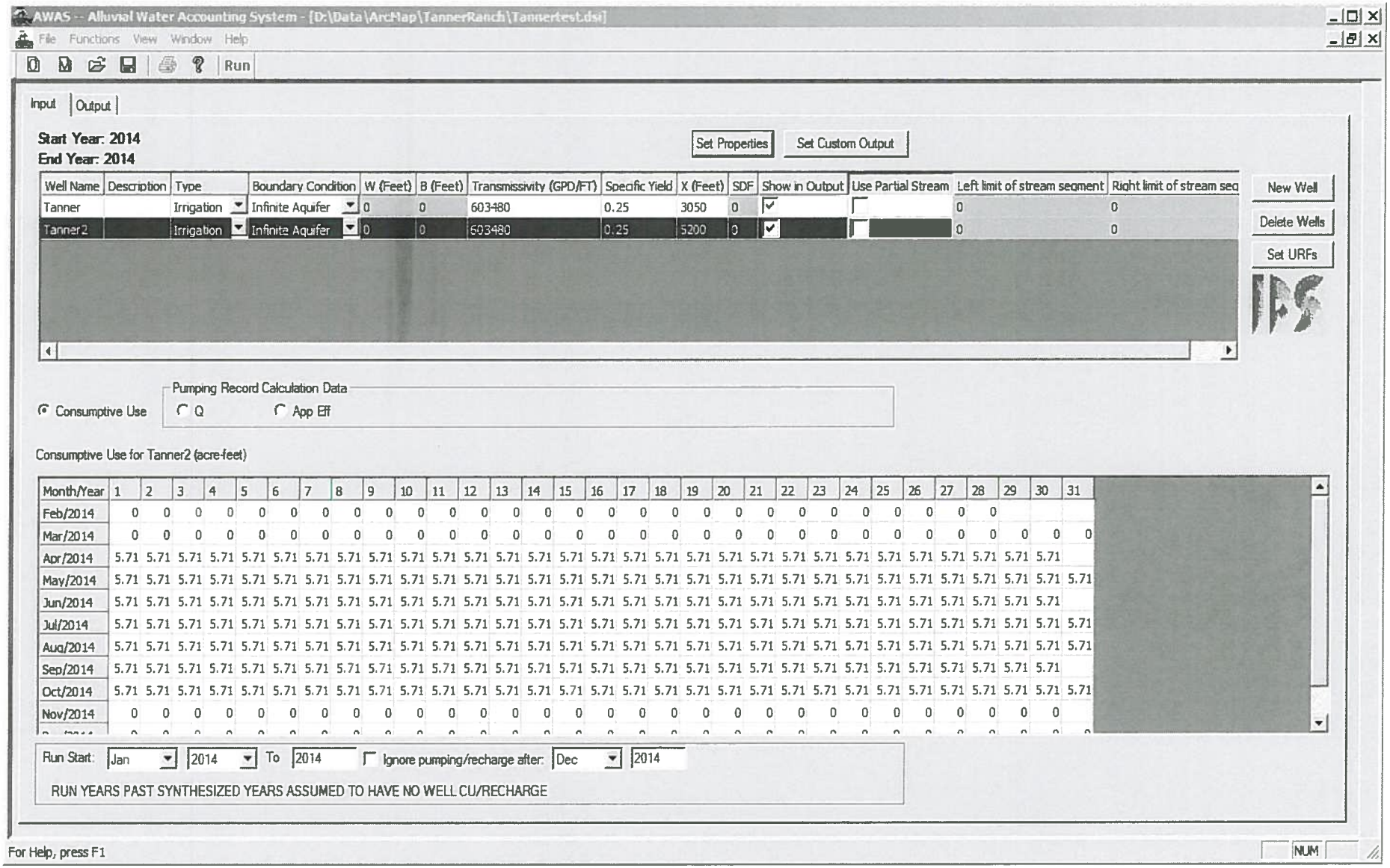

Figure C-3. Input parameters for the Tanner Lane Ranch well farthest from the Blackfoot River.